A liberal amount of gold dust and a number of the slides, some of them dated 1902, were placed in water, and thoroughly boiled. As soon as the cover slips came off of their own accord, the slides and slips were placed in a pan of water. These were wiped dry while others were being boiled. The ease with which they can be cleaned and dried and the small amount of time required compared to the waste-xylol method, makes it a very profitable undertaking.

On taking them from the gold dust solution they were first placed in waste alcohol, but it was found by placing them in water they could be cleaned and dried much easier.

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ENTOMOLOGICAL NOTES

Chromosomes of Notonecta.—Browne ('16, Journ. Morph., 27:119-162) has made a comparative study of the chromosomes of five North American species of *Notonecta (undulata, irrorata, insulata, shooterii,* and *indica)* and one species of the same genus from Europe *(glauca).* Among other things, it was found that an XY pair of chromosomes is present in each of the above-mentioned species, the components of which divide separately in the first division and go to the opposite poles in the second. The X and Y chromosomes vary in size in the cells of the different species as well as in the cells of different individuals of the same species. They are almost equal in most of the cells of certain individuals of *shooterii,* while in *indica* they are distinctly unequal. *Undulata, indica,* and *shooterii* have 14 chromosomes in the first division, 13 in the second, and 26 in the diploid groups. *Irrorata* and *glauca* have 13 chromosomes in the first division, 12 in the second, and 24 in the diploid groups. *Insulata* has 14 or 13 chromosomes in the first division and 12 in the second. Large double chromosomes occur in *insulata, glauca,* and *indica.* No definite correlation of the somatic characters of the different species with the difference in chromosomes number and arrangement was discovered, although it was found that the 14-chromosome species are the smaller and the 13-chromosome ones are the larger. It thus appears that while,

in general, a definite number and arrangement of the chromosomes of each species exist, the status of each species in relation to the others cannot at present be determined on this basis. The chromosomes and somatic characters seem to indicate that *indica* has been derived from *undulata.*

Mitochondria.—Lewis and Robertson ('16, Biol. Bull., 30:99-124) studied, by the tissue culture method, the mitochondria and certain other structures in the male cells of the grasshopper *Chorthippus curtipennis.* By using a culture medium which very closely approached Locke's solution, it was found that, in addition to the fact that the minute structures of the living cells could be examined from day to day, these structures could be experimented upon as readily as those of the chick embryo. Any stage in the development of the germ cell was obtained by this method and was studied in the stained and unstained conditions, the staining being done with Janus green and neutral red. By these methods, mitochondria and neutral red granules were demonstrated in the primary spermatogonium. The former are present in the primary spermatogonium as small, delicate granules and increase in quantity during the growth stage, becoming definitely arranged along the spindle during the spermatocyte division. In the spermatid, they form the nebenkern, later developing "into two equal homogeneous threads in the tail of the spermatozoön."

Gynandromorphism.—Cockayne ('15, Journ. Genetics, 5:75-131), in a paper entitled "Gynandromorphism and Kindred Problems", presents a comprehensive discussion of gynandromorphism among animals, the greater part of the data being drawn from insects. Descriptions of a number of new examples are presented. The data included in the paper are not readily summarized and cannot be included here. A somewhat elaborate and suggestive classification of "hermaphrodites" is given. The theoretical explanations of gynandromorphism are taken up in some detail and considered critically. A number of text figures illustrate the condition of the internal reproductive organs in some of these anamalous insects. Four plates devoted exclusively to Lepidoptera illustrate certain forms of gynandromorphs. A bibliography of sixty-eight titles accompanies the paper.

Color Changes in Dynastes.—Andrews ('16, Journ. Exp. Zool., 20:435-456) reports results of studies on color changes in adults of the rhinoceros beetle, *Dynastes tityrus*. It was discovered that when live specimens of either sex which were light yellow with dark spots were confined for a time in receptacles with wet decayed wood, they all became very dark reddish with the spots scarcely visible. When removed from these conditions, they rapidly returned to the usual light coloration. Since such changes in an animal having no changeable pigment cells or blood vessels so distributed as to make color change possible seemed to be unrecorded, experiments were undertaken to determine the nature of this phenomenon. Variations in moisture were found to underlie the conditions which produced the color changes. These color differences can be explained without the assumption of internal nervous activity since, in general, the reactions of a dead, dried specimen were the same as those of the living beetle in all respects concerning the change of color from light to dark and the reverse. Experiments with light, heat, and moisture yielded results which made it evident that both living and dead beetles behaved alike in changing color under conditions which were interpreted as chiefly involving differences in the amount of water presented to the surfaces of the elytra and the thorax. Results of experiments pointed to the conclusion that any liquid which can enter the shell may cause it to change from light to dark color. Microscopical examination of the elytron showed that it is composed of an outermost layer of such a nature that it readily absorbs and gives off moisture. The absorption of liquids permits the color of the underlying part of the exoskeleton to appear as dark red, whereas when air replaces the moisture in this layer, it prevents the underlying color from showing through. The dark spots which do not change appear to be due to the presence of some material which so fills the pores or interstices that it acts as if it makes the area permanently wet or to some degree soaked with liquid, thus rendering visible the underlying color. The relation of these color changes to the life activities of the insects is not known.

Light Reactions of Vanessa antiopa.—Dolley ('16, Journ. Exp. Zool., 20:356-420) finds that *Vanessa antiopa* is invariably

positively phototactic and in direct sunlight comes to rest with the head away from the source of light. Specimens with one eye blackened and placed face foremost in a horizontal beam usually turn toward the functional eye, occasionally continuing to turn in this fashion, thus performing circus movements, but usually reversing the movement at the edge of the beam and moving toward the source of light. In non-directive light, the insects perform circus movements only, each turning toward the functional eye. Apparently, the stronger the light the larger are the circles described by the insect. Non-directive light of very low intensity does not deflect either way specimens with one functional eye but a further reduction of this light leads to the performance of circus movements toward the blinded eye. The behavior becomes modified by repeated trials, the modification being manifested in three ways: (1) decrease in number of circus movements; (2) decrease in angle of deflection; and (3) increase in promptness of orientation at edge of beam. With one eye blackened, this insect, when moving toward a source of light, can re-orient when the direction of the rays is changed and always in such a way as to turn toward the source of light. In darkness, blinded specimens move in circles toward the blinded eyes, showing that the covering acts as a stimulus. In light, blinded specimens circle in the opposite direction, showing that light received by the functional eyes is the stimulus. Evidence indicates that the reaction may depend upon the localization of photic changes within the eyes and that orientation is not wholly dependent upon the relative intensity of light on the functional and blinded eyes.

Origin of Wings.—Crampton ('16, Journ. N. Y. Ent. Soc., 24:1-39) presents a thoroughgoing summary and critical examination of the various theories relating to the origin of wings in insects. Special attention is given to a comparison of the evidences advanced in support of the *tracheal gill theory* and the *paranotal theory* of the origin of insect wings. The latter is favored and some original data are offered in its support. The wings of all insects are regarded as homologous and of common origin, thus being subject to the same principles regardless of the kind of metamorphosis. Tracheal gills and wings have been shown by em-

bryological studies to belong to different developmental series and are not homologous, facts which offer very strong counter-evidence against the derivation of wings from tracheal gills. Since the paranota (integumental outgrowths on the sides of the tergum) are homodynamous with the wings, the latter "were doubtless derived from them, since they occur in the most diverse forms". The only reliable evidence available at present is that of embryology, such evidence indicating that the wings are of tergal origin. It is also concluded that the paranota from which the wings are thought to have originally developed were entirely or in part expansions of the tergum. A bibliography of two hundred twenty-two titles accompanies the paper.

Wing Venation of Hymenoptera.—Rohwer and Gahan ('16, Proc. Ent. Soc. Wash., 18:20-72) have published a paper on the "Horismology of the Hymenopterous Wing" in which a modified form of the old Cresson system of wing venation terminology is proposed. The paper is valuable because of the extensive synonymy and comparisons of the systems used in the past, thus making much easier the translation of one system into another and the determination of equivalent names. The new system which is proposed is based on the opinion of the writers that "it is better for taxonomatic work to designate a given area by a given name and call it that regardless of its possible homologies or analogies." The new system is constructed only for insects of the order Hymenoptera and is apparently a revival of the old custom of using different systems of terminology for venation in the different orders and of using purely arbitrary systems rather than those based on homology. The writers point out what they consider to be objections to the Comstock-Needham system but there is doubt that these objections are well taken. Unfortunately, such a system as the one proposed in this paper, in spite of its possible commendable points, will have the effect, if adopted at all extensively, of impeding the development of a common system, based upon homologies, for all of the orders of insects, a system much to be desired.

Parasites.—Timberlake ('16, Can. Ent., 48:89-91) finds that certain insects (beetles) may be parasitized by *Dinocampus americanus,* a common braconid parasite, without producing the death

of the host. It was observed that certain individuals of *Hippodamia convergens, Coccinella 9-notata,* and *Olla abdominalis* might be parasitized, the larva attain full growth and escape, and the recovery of the host be apparently complete. Experiments in which individuals of *Hippodamia convergens* and *Olla abdominalis* were exposed to the parasite showed that this particular parasite does not injure the vital organs of the host, although its fatty lymph tissues are often left in such a depleted condition that the beetle soon dies. The exit aperture of the parasites is itself sometimes fatal in effect. These experiments showed that successive parasitism may occur, resulting in the emergence of more than one generation of the parasite from the same host.

Insects and Fire Blight.—Stewart and Leonard ('16, Phytopathology, 6:152-158) report the results of experimental studies on the rôle of insects in the dissemination of fire blight bacteria. Experiments with certain Diptera *(Pollenia rudis* and *Sapromyza bispina)* seem to indicate they they are not active agents in increasing the number of twig blight infections, since their method of feeding is such that it is doubtful if the blight bacteria which they may carry can gain entrance to the tissues. Possibly the bacteria carried by the flies may gain entrance through the punctures of other insects and produce a few infections. Flies are thought to be most important in those cases where they carry the causal organism to blossoms and occasionally to wounds, such as those produced by hail stones. The authors believe that all of the sucking bugs in nurseries are important in this connection. The numbers, methods of feeding, and seasonal distribution make the various species of different interest and importance in the transmission of blight bacteria. It is suspected that those which feed upon the tender tips of the twigs are of more importance than those which feed upon other parts of the foliage. *Lygus invitus, Heterocordylus malinus* and *Lygidea mendax* are of importance in spreading fruit blight in orchard trees.

Embryology of Honey-bee.—Nelson ('15, Princeton Univ. Press) has recently published a book on "The Embryology of the Honey Bee", which is the most comprehensive and thoroughgoing treatise that has yet appeared on this subject. The author has been

concerned not only with the details of the development of the honey-bee but he has employed the comparative method of treatment, drawing extensively upon the works of other investigators on the embryology of insects in general, thus making the book valuable in connection with any work in insect embryology. The large mass of data cannot be summarized here but certain special features deserve mention. The duration and rate of development were specially considered and it was found that the total time normally required for embryonic development is 76 hours. This period is divided into stages I-XV. Cleavage requires 14-16 hours; formation of blastoderm, 14-16 hours; formation of mesoderm, rudiments of mesenteron and embryonic envelope, 12-14 hours; remainder of development, including differentiation of tissues and organs, 32-34 hours. Discussion of the formation of the mesenteron is accompanied by an extensive comparison of the various opposing views and interpretations of other investigators on this subject. The different writers are classed according to the following theories of mesenteron origin: (1) derivation from yolk cells; (2) derivation from the lower layer (mesoderm, entomesoderm, primary entoderm); (3) derivation from proliferations of the blind inner ends of the stomodæal and proctodæal invaginations; (4) derivation, independent of the mesoderm, from two proliferating areas of the blastoderm, one at each end of the germ band, corresponding to the future location of the stomodæum and proctodæum, respectively; and (5) derivation from cells migrating inward from thickenings or islands of the blastoderm. Nelson holds that "the relation of the mesenteron rudiments in the honey bee may be interpreted in two ways, and the one chosen will probably depend largely on the theoretical bias of the interpreter. First, the mesenteron rudiments may be referred to the mesoderm .....Second, the mesenteron rudiments may be considered, ...as purely blastodermal in origin." A final decision between these two interpretations is not attempted. Segmentation is considered rather fully and is found to be as follows: head, six segments; thorax, three segments; and abdomen, twelve segments. Appendages were observed on the antennal, the three gnathal, and the three thoracic segments. There is evidence that in the honey-bee the tritocerebral (intercalary) segment should be

considered as "exaggerated ganglionic swellings" which probably do not represent appendages. Nelson has found nothing which could be "safely construed as abdominal appendages". Degenerating cells of unknown significance occur in the rudiments of the brain, particularly in the region between the second and third lobes of the protocerebrum. The tracheal system is formed from eleven pairs of invaginations of the lateral ectoderm, one pair, which seems to be observed for the first time, occurring on the second maxillary segment. This discovery is significant since "Now that a pair of tracheal sacs is known to exist in the second maxillary segment, the homology of the second pair of tentorial invaginations with the stigmata of the second maxillary segment is completely excluded, and the homology of similar invaginations with those of the trachea is decidedly problematical". The tentorium develops from two pairs of ectodermal invaginations, one in front of the bases of the mandibles and the other behind the bases of the first maxillæ. The œnocytes develop from the migration of cells from eight pairs of localized areas of the lateral ectoderm which occur on the first eight abdominal segments at the same level as the tracheal invaginations. The mesoderm differentiates laterally into a somatic and a splanchnic layer, the mid-ventral region remaining single layered. Separate cœlomic sacs are wanting. The single layered area develops into the rounded blood cells; the somatic layer forms the trunk muscles, the pericardial fat cells, and the dorsal diaphragm; and the splanchnic layer gives rise to the muscle layer of the mid-intestine and the two main divisions of the fat body. A mid-dorsal union of two rows of cardioblasts, derived from the two mesodermal layers, forms the heart. Two masses of mesodermal cells, one forming the anterior and one the posterior end of the mesoderm, produce the muscle layer of the stomodæum and the proctodæum respectively. One hundred fifty-seven titles are included in the bibliography at the end of the book.

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NOTES ON OLIGOCHÆTA

Galvanic Response of Earthworm.—Moore and Kellogg ('16, Biol. Bull., 30:131-134) have tested the galvanic reaction of